Anchor Coil Technique for Arteriovenous Fistula Embolization

A Technical Note

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Summary

We describe a case of arteriovenous fistula (AVF) successfully treated by coil embolization with an anchor coil inserted in the varix to facilitate dense packing at the shunting site. AVF of the left anterior choroidal artery (AChoA) draining into the ipsilateral basal vein of Rosenthal was incidentally found in a newborn female. A single detachable coil was inserted as an anchor into the varix adjacent to the shunt, and the microcatheter was pulled back to the shunting point. Three more detachable coils were delivered at the shunting point without migration under the support of the anchor coil, and the AVF was successfully obliterated with preservation of AChoA blood flow. The anchor coil technique can reduce the risk of coil migration and the number of coils required.

Introduction

N-butyl-2-cyanoacrylate (NBCA) or detachable coils have been widely used as embolic materials in the endovascular treatment for the arteriovenous fistula (AVF). NBCA is an adhesive liquid agent not easy to control. Therefore, distal glue migration through shunts or accidental occlusion of normal arteries has frequently been reported [1-4]. By contrast, detachable coils are amenable to control, and accordingly coil embolization has been considered safer than NBCA embolization [5,6]. However, migration of coils has also been described as a serious complication. Furthermore, complete occlusion of the AVF cannot be always achieved by coiling, and a considerable number of coils is sometimes necessary in case of large AVF.

This report describes a case of AVF, successfully occluded by coil embolization with a few coils. In the procedure, a single coil was placed in the varix as an anchor to facilitate proximal packing at the shunting site.

Case Report

A female neonate was referred to our hospital with a diagnosis of intracranial mass lesion. She was delivered as one of triplets weighing 2156 grams, and the lesion was incidentally found by computed tomography of the brain conducted as a screening for her low birth weight. An intracranial AVF was suspected by magnetic resonance (MR) imaging (Figure 1A), and cerebral angiography demonstrated the AVF with a single short arterial feeder originating from the left anterior choroidal artery (AChoA) draining into the enlarged ipsilateral basal vein of Rosenthal (Figure 1B). Physical examination of the infant showed no abnormalities such as heart failure or neurological deficits. Although she was asymptomatic, cerebral AVF is often associated with a poor prognosis. Therefore, endovascular coil emboliza-

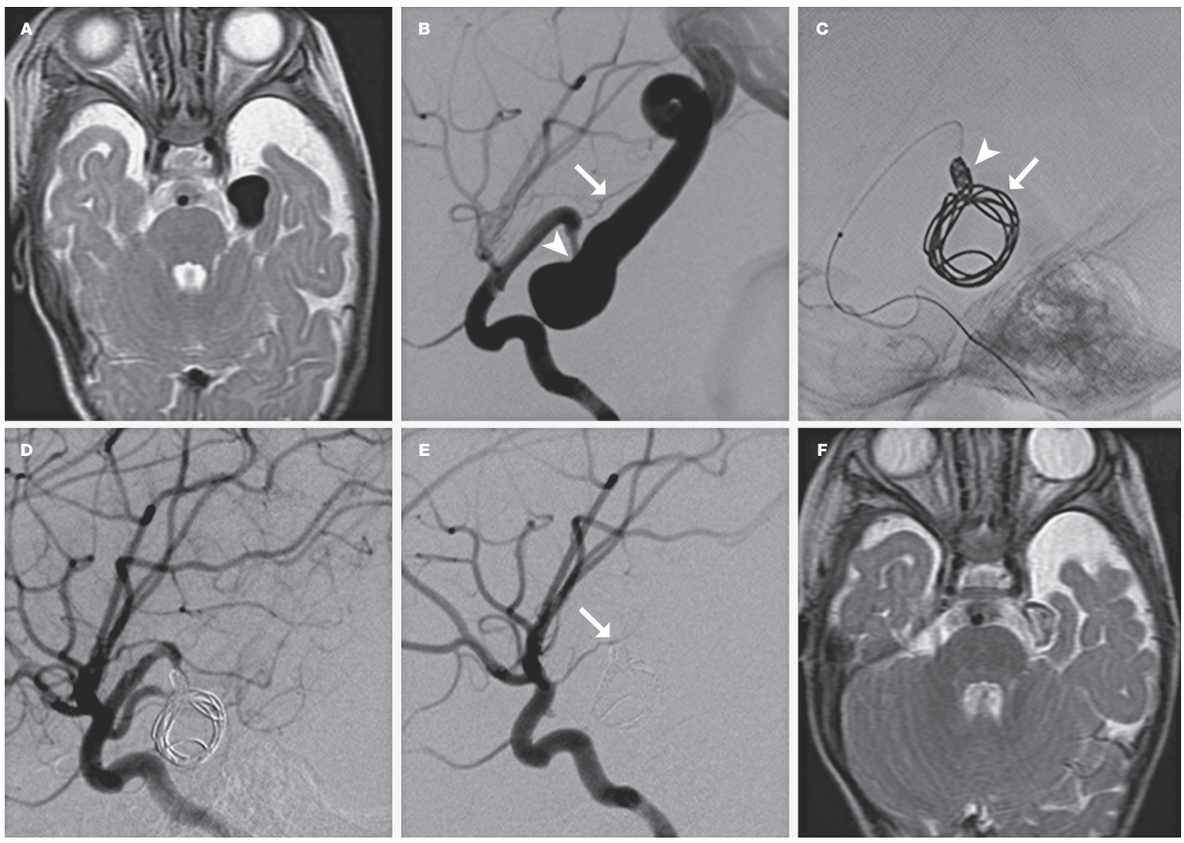

Figure 1 A) T2-weighted MR imaging reveals a low intense flow void located medial to the left temporal lobe. B) Lateral view of the left internal carotid angiogram demonstrates the AVF fed by the dilated left AChoA shunting to the ipsilateral basal vein of Rosenthal. The distal AChoA (arrow) originated just proximal to the fistula point (arrowhead). C) Lateral plain craniogram shows a single anchor coil (arrow) in the varix and 3 additional coils at the fistulous point (arrowhead). D) Post-embolization left internal carotid angiogram shows complete obliteration of the AVF. E) Left internal carotid angiogram 3 months after the embolization revealed no recanalization of the AVF and normalization of the AChoA. F) T2-weighted MR imaging at the same time showed shrinkage of the varix.

tion of the AVF was planned at the age of eight months to allow the infant to develop to be able to tolerate the endovascular treatment well. Thereafter, she grew with a weight of 7290 grams, and underwent endovascular treatment as scheduled. Under general anesthesia, a 4 French catheter (Cerulean G; Medikit, Tokyo, Japan) was introduced to the left internal carotid artery via a femoral approach. Heparinization was initiated with a 500 IU intravenous heparin injection without any additional dosage. A microcatheter (Excelsior 1018; Stryker Neurovascular, Fremont, CA, USA) was advanced to the varix through the dilated AChoA. A single detachable coil (Guglielmi detachable coil (GDC) 18 3D 16 mm × 30 cm; Stryker Neurovascular) was delivered in the varix as an anchor (Figure 1C, arrow). Then, the microcatheter was pulled back to the shunting point. To facilitate thrombosis and occlusion of the AVF, a fibered coil (GDC 18 Vortx 2 mm × 3 mm; Stryker Neurovascular) was delivered at the shunting point under the support of the anchor coil. Additionally, two detachable coils (GDC 10 UltraSoft 2 mm × 4 cm; Stryker Neurovascular, ED coil Extra Soft 1.5 mm × 2 cm; Kaneka medix, Osaka, Japan) were delivered to secure the complete occlusion of the AVF by increasing the density and length of the coils (Figure 1C, arrowhead). Accordingly, the AVF was successfully occluded with preservation of AChoA flow (Figure 1D). The baby was discharged without any neurological deficits and continued normal development. Follow-up angiograms three months after the embolization showed no recanalization of the AVF, and con-

figuration of the AChoA was normalized (Figure 1E, arrow). MR imaging at the same time revealed shrinkage of the varix (Figure 1F).

Discussion

We described a rare infant case of high flow AVF of the AChoA successfully treated by coil embolization. The anchor coil delivered in the varix was very helpful to place the succeeding detachable coils at the shunting point of the AVF. Cerebral AVFs are rare accounting for 1.6 to 8.4% of all brain arteriovenous vascular malformations in reported case series [5,7,8]. The AVF with a shunt from the AChoA to the basal vein of Rosenthal in the present case is extremely rare and only one case was reported in the past [9]. AVF are usually diagnosed at an early age. In neonates and infants, they frequently develop heart failure, followed by seizure, or hemorrhage. In children, they often develop hemorrhage, followed by seizure, neurological deficits, or headaches [8,10]. However, they are sometimes diagnosed incidentally [6]. Although the natural history of cerebral AVFs remains to be elucidated, a high mortality rate (63%, five out of eight patients) as a result of hemorrhage was reported when they were conservatively treated [11]. Therefore, they have usually been treated aggressively.

To date, intracranial AVF have been treated with NBCA or coils. Migration of embolic material is the most problematic complication of AVF embolization [1,3,5,6,12]. The disadvantage of NBCA embolization is the difficulty in controlling its distribution resulting in major complications such as lung or cerebral venous migration and/or normal arterial occlusion. On the other hand, detachable coils are considered controllable to deliver and coil embolization has been thought to be safer than NBCA embolization in the cases of AV shunts. However, even coils are not stabilized in high-flow vessels and accidental migration of the coils into the distal vessels can also occur especially in high-flow cases [6]. Therefore, to prevent coil migration, embolization commonly starts with delivering coils of large diameter to fit the widest cavity of the drainer. Then, additional coils are introduced to the first coil to pack the vascular lumen. In the anchor coil technique we used in the present case, the anchor coil served as an obstacle to succeeding coils against migration of the coils.

As described above, to achieve a complete cure of the AVF, the shunts should be occluded by the insertion of coils into the large dilated cavity of the drainer. Consequently, a considerable number of coils have inevitably been used [13]. If the fistulous point, instead of the enlarged drainer, can be directly embolized, the AVF would be cured with fewer coils. In the present case, occlusion of the AVF could be achieved by only three coils at the fistulous point owing to the preset anchor coil. In addition to the safety, the medical care cost saving is another advantage of this technique.

Because a varix is often formed just distal to the shunting point in cerebral AVF, the anchor coil technique can be applied widely to its embolization. If the varix is spherical in shape, a few coils in the varix would be enough as an anchor. In case the varix is oval in shape, a coil with a larger diameter than the transverse diameter of the varix may fit and form a good anchor. If the varix is a long slim oval in shape, a few coils might need to be arranged in series to deliver the anchoring coil at the entrance of the varix.

MR imaging three months after the treatment showed shrinkage of the varix. If the varix had been fully packed with coils, the shrinkage could not be expected. The anchor coil method could allow the varix to shrink owing to the reduction of delivering coils. Therefore, the concept of this technique can be applied to the treatment of AVF presenting with mass effect of the varix.

Conclusions

The anchor coil technique can reduce the risk of complications due to coil migration and the number of coils contributing to patient safety and social medical economics.

References

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